Why (else) is J0537-6910 interesting to us?

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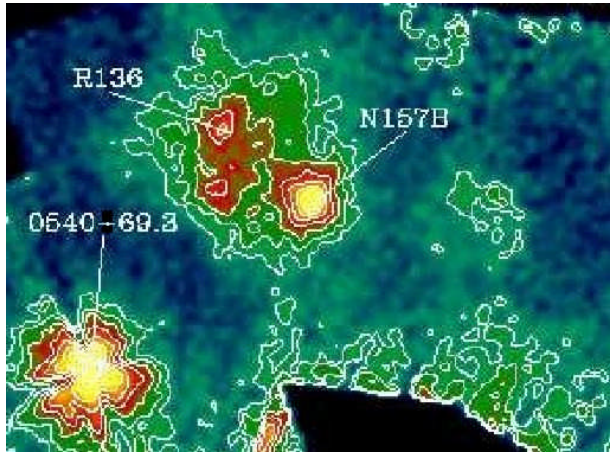
The story

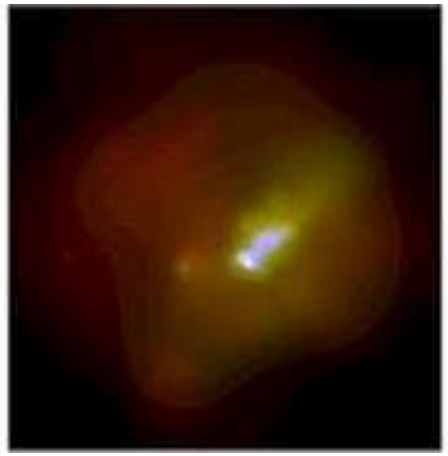
- Discovery paper in 1998: Middleditch & co. were looking for SN 1987A x-ray pulses
- (Same time as r-modes got big … more later)
- Found 16ms period (2x faster than Crab), but in wrong supernova remnant
- Radio and optical don't see the pulsar, and there's no companion (THIS IS NOT AN LMXB)
- Spindown comparable to Crab (2×10^{-10} Hz/s)
- Glitches several times per year (record holder)

The remnant

- N157B, one of many in Large Magellanic Cloud (confirmed by H density)
- X-ray “comet” around pulsar = jet interacting w/remnant (synchrotron, not thermal)
- Sedov age (spectrum & adiabatic expansion) 5000yr inferred before pulsar found
- “Comet” & typical kick also imply 5000yr age
- Spindown age -f/(2df/dt) also 5000yr (???)



ASCA image: Gotthelf & Wang

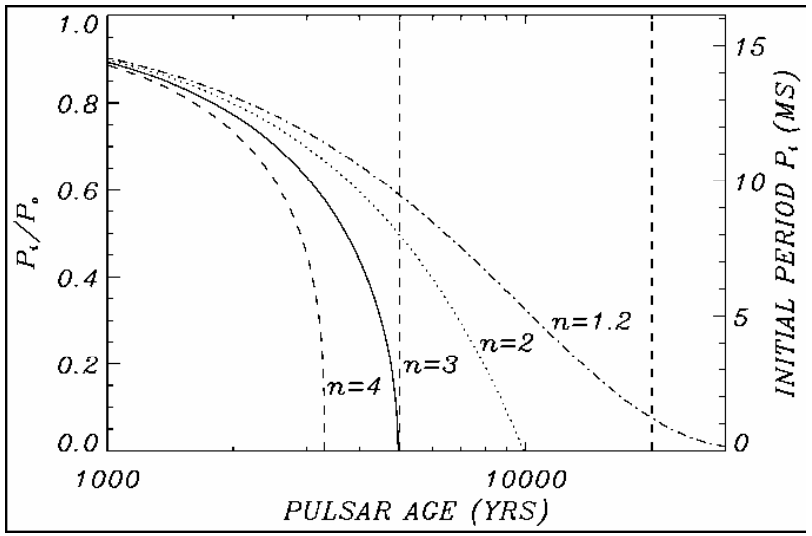


Chandra image: Harvard CfA

The frequency

- New record 62Hz for young pulsars, near record df/dt
- Assume B-dipole (braking index n=3) and it was born at infinite frequency!
- Or just very fast for n<3, I.e. fast enough for r-modes to have been operating
- (Despite J conservation, this is not common…)
- Can't get reliable braking index because…

Marshall et al. 1998

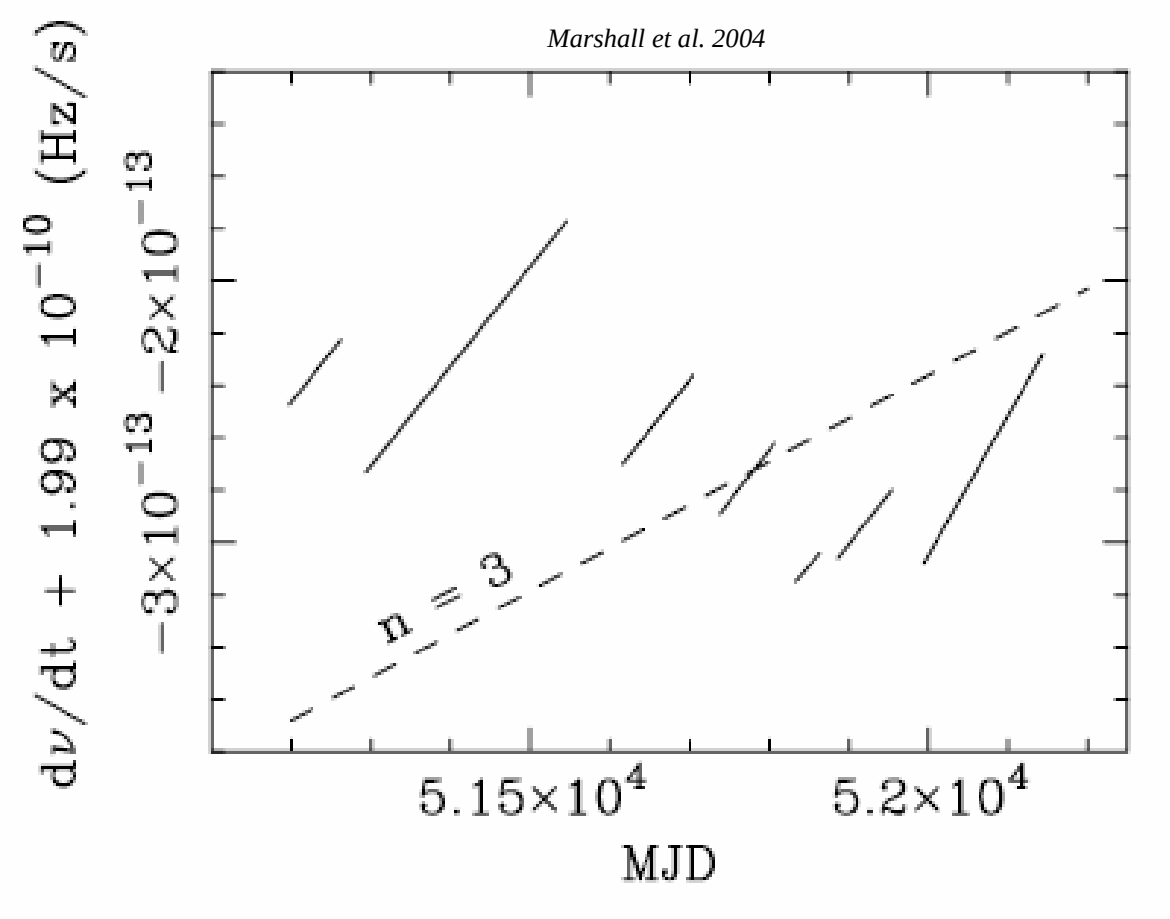


The glitches

- Rate 2-3/yr beats Crab by order of magnitude
- Average relative frequency jump-up 3×10^{-7}
- Average relative df/dt jump-"up" 3×10^{-4}
- So many glitches so big that spindown age -f/(2df/dt) *decreases* at 1yr/yr! (abs(df/dt) increases)
- Can predict next glitch time to few % from amplitude of last glitch
- Some claims that glitchiness is due to recent phase transition, backbending would imply initial 6ms period (not zero) for n=3 due to J emission history

The glitches

Marshall et al. 2004



The bottom line

- We know where this thing is
- We don't know much else (structure-wise)
- Except that it's very odd and very interesting

- I screwed up a factor 2 in my Amaldi article - this should be the 3rd pulsar initial LIGO can (barely) get to the spindown limit with a small upgrade